Increasing Financial Inclusion in Mozambique

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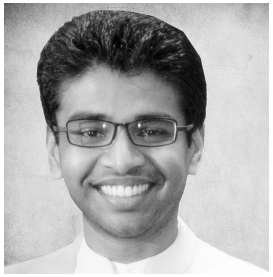
The team

Principal Data Scientist and Economist at Juntos, a behavioural design company working in the financial inclusion space. Previously worked as Global Macroeconomic Strategist for Barclays.

Civil Servant at the Central Bank of Spain with a Law and Finance background.

Chartered Financial Analyst. Five years of experience in alternative investments, due diligence and investment sourcing in both developed and developing markets.



Six year of experience in financial inclusion across five countries in Africa, Asia and Oceania. Consulted for leading financial institutions and donors including Gates Foundation, Omidyar Network, UNCDF and USAID.

Project Objective

The project has a main strategic objective and two tactical objectives…

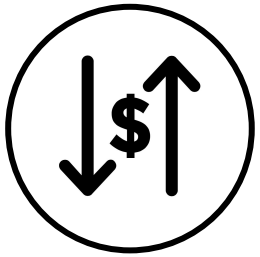
1 Make policy recommendations to build an inclusive financial sector in Mozambique

2 Incentivize formal financial institutions to serve the unbanked population

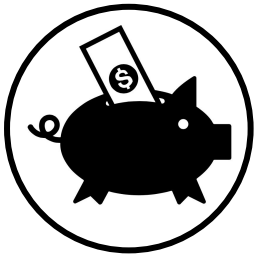
3 Identify districts with higher potential for financial services

Why financial inclusion matters?

A growing body of evidence suggests...

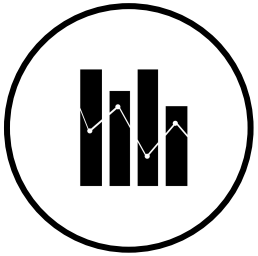


Poor people do not live in static poverty



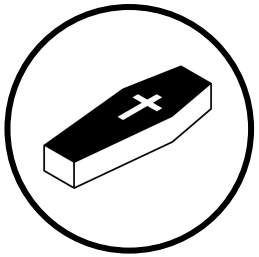
...and they are active managers of finance

However, it's the inability to safeguard themselves from financial shocks that pushes them deeper into poverty.



Income shock

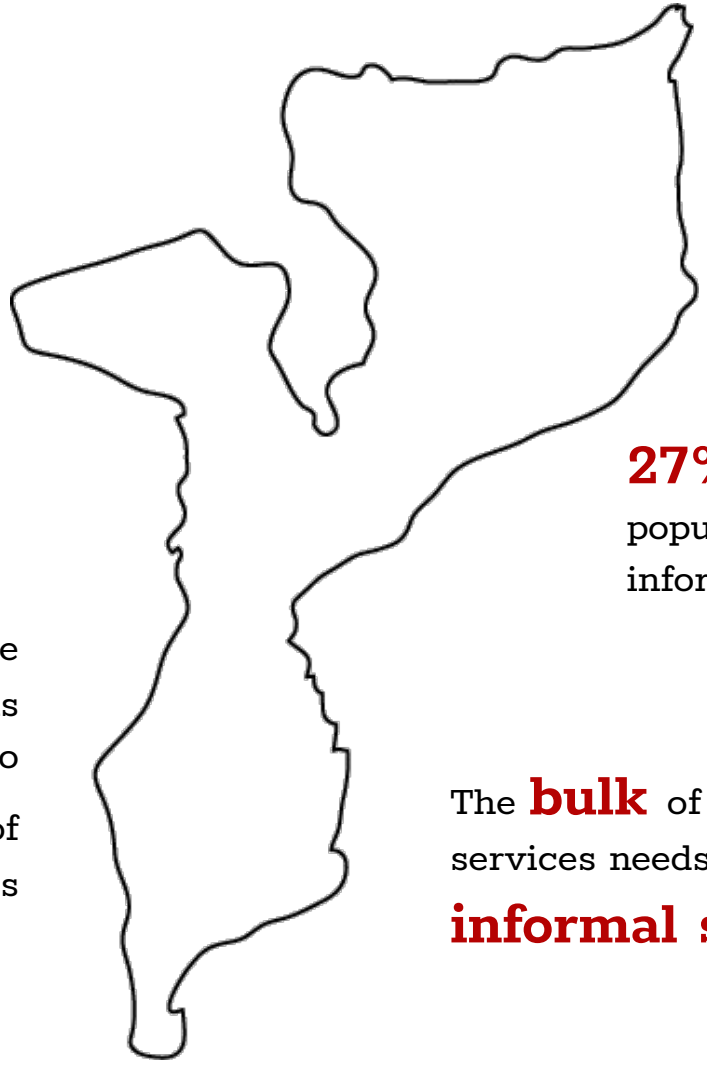
Natural calamity



Lifecycle shock

Financial inclusion in Mozambique

Nearly **60%** of the adults do not have access to **any sorts** of financial services



Seven times fewer bank branches serving rural areas compared to urban ones

27% of the adult population rely only on informal financial service

Only **31%** of the adults in rural areas have access to **some sort** of financial services

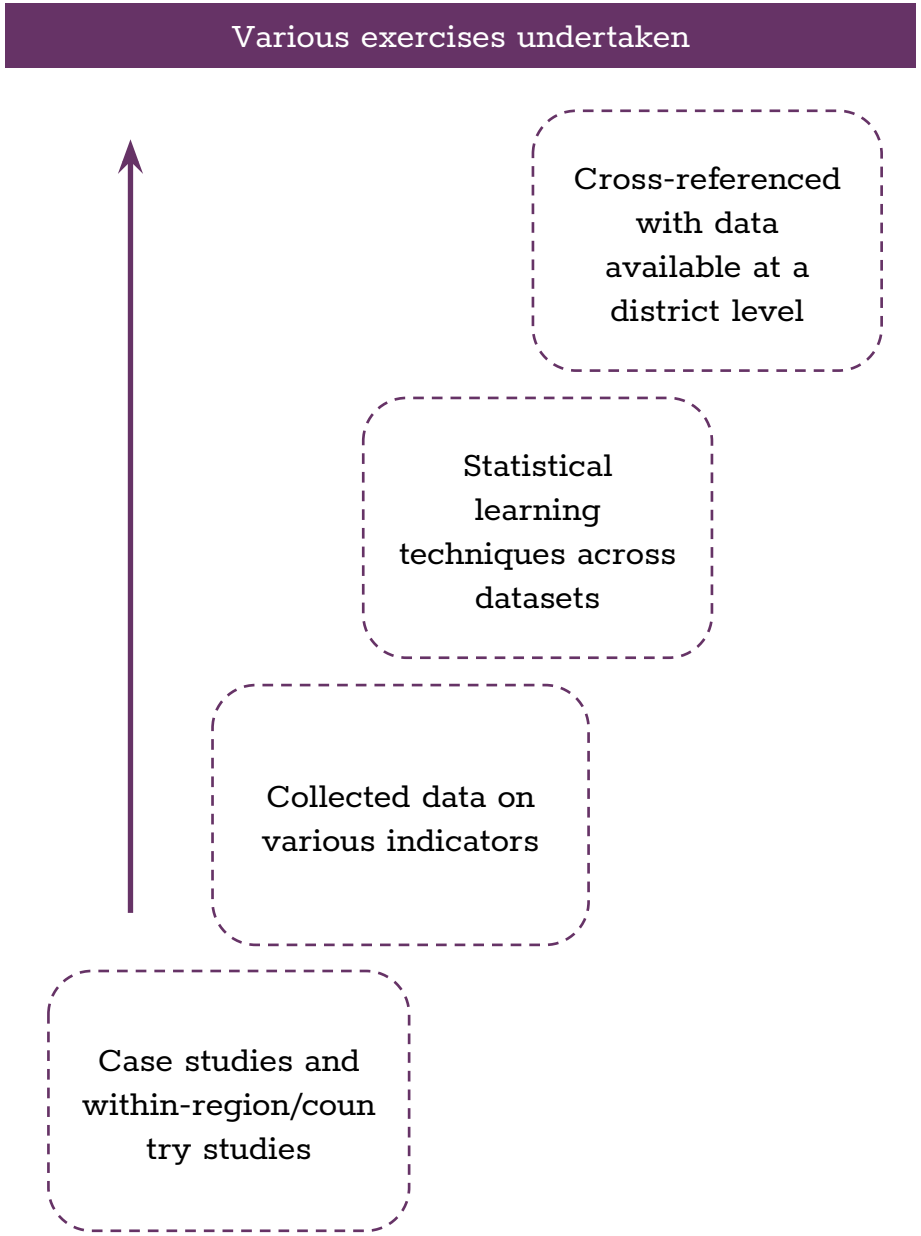
The **bulk** of the nation's financial services needs are met through **informal services**

Essentially, financial inclusion in Mozambique is in an extremely nascent stage

*Source: Finscope 2014

Process: Started by identifying variables

- Qualitative identification:
  - Population, Population density, and Financial Access Points
- Little survey data available at district level
- Few insights from cross-country data.
- **Main discovery:** Large proportion of the variance in the data was explained by a single variable: Income
  - **This became our basis for using the Night Light data as a proxy for income**



Night Lights Data

Defense Meteorological Satellite Program provides night lights data measured during the dark half of the lunar cycle in seasons when the sun sets early that removes intense sources of natural light and leaves mostly man-made light

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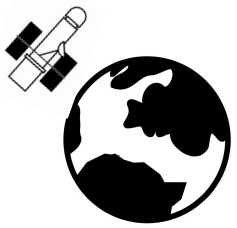
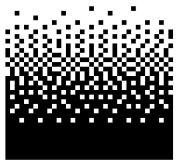


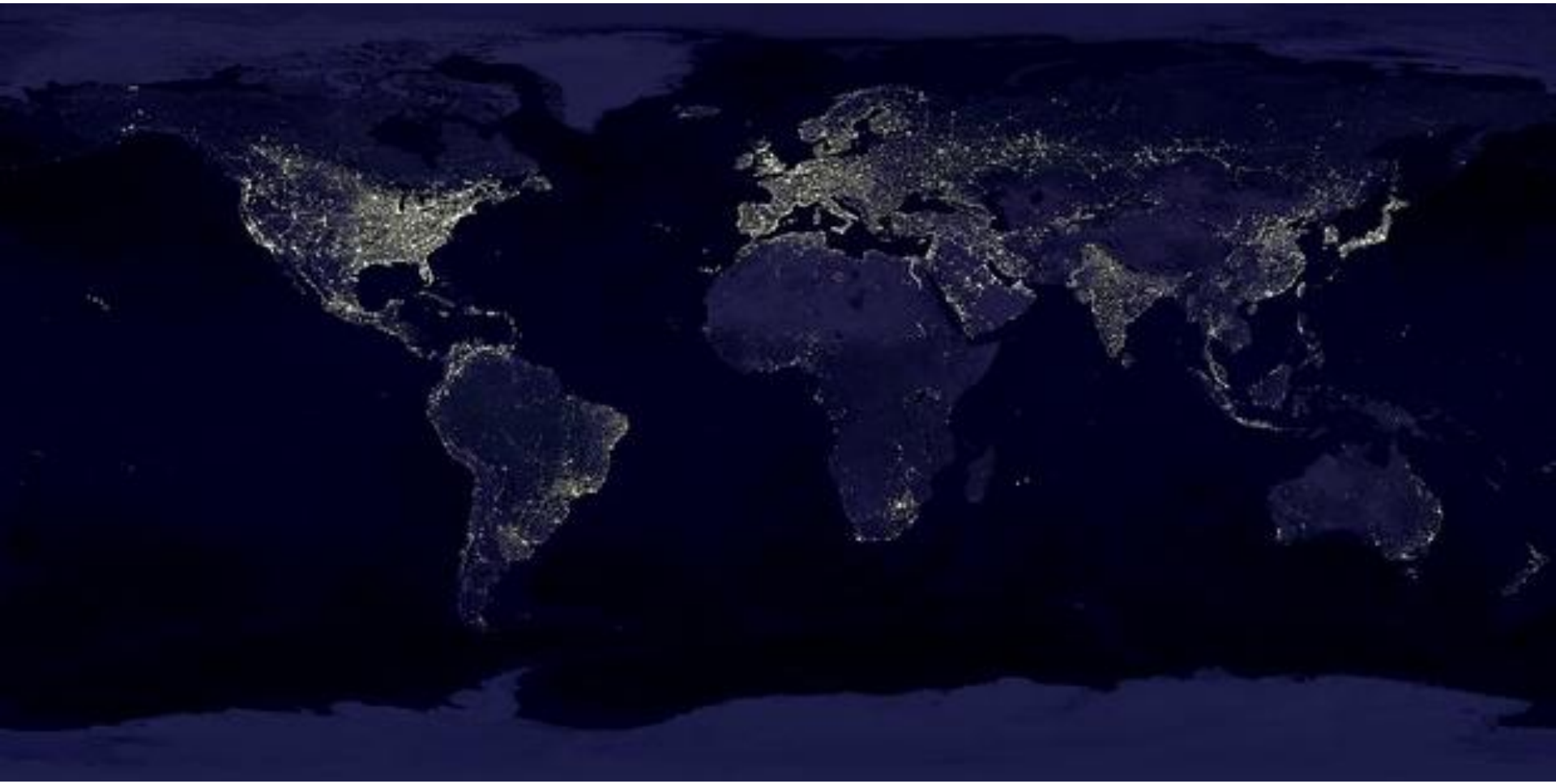
Several **US Air Force weather satellites** circle the earth **14 times per day**, recording the intensity of earth-based lights

Covers virtually the **entire earth** between about **8:30-10.00 PM** when it is night time at least once every **24 hours**



Measure of intensity of lights is a **six-bit** digital number calculated for every **30-second output pixel** (approximately 0.86 square kilometers at the equator)

Night Lights Data



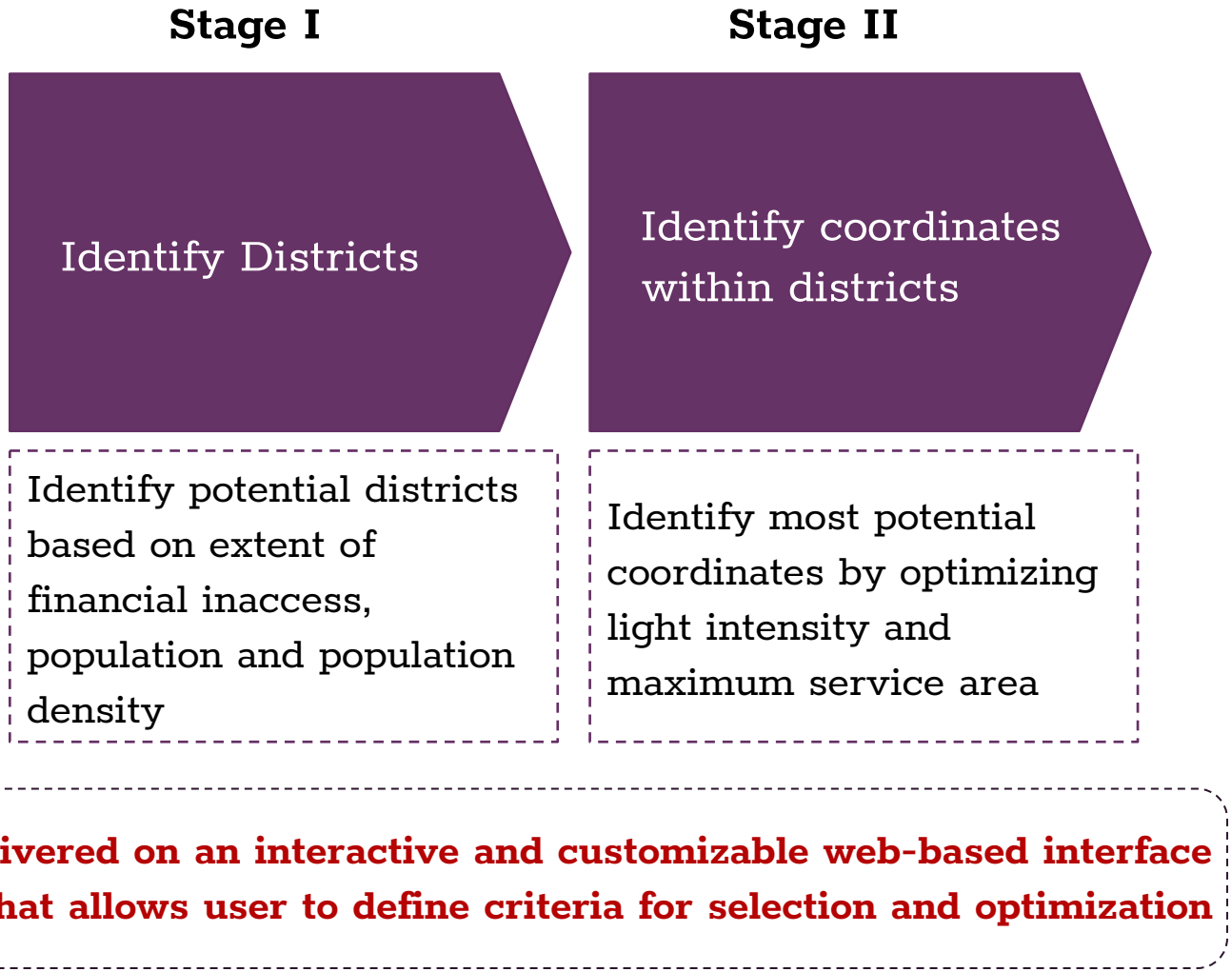
Relevance of Night Lights Data

1	2	3	4
Income & Lights	**Electricity & Lights**	**Human Development & Lights**	**Information and Technology & Lights**
Individuals with sufficient incomes make attractive customers to a wider range of financial services providers. As consumers gain income, they are also more likely to demand more and better formal financial tools	Availability of electricity is an important prerequisite for electronic and mobile banking. Lack of infrastructural facilities especially electricity increases the operational expenditure for financial institutions in rural areas.	Financial capital combined with poor human development lead to poor outcomes. Banks that offer microcredit loans for small businesses and income generating activities have a higher incentive to operate in regions that have a relatively higher human capital development.	Availability of technology within the low-income population presents a new opportunity for financial institutions. Access to technology enables consumers to generate data, which can be used for alternative credit scoring and sanctioning. FIs can effectively communicate with their consumers and engage in financial literacy and consumer protection programs.

Corroborated by various academic researches

Methodology and process

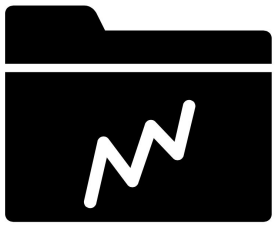
The process of identification of potential areas consists of two stages



Delivered on an interactive and customizable web-based interface that allows user to define criteria for selection and optimization

Stage I: Identify Districts

Stage I — Data collection and district identification



Data collection

- Collected district-level data on population, population density, and financial access
- Selected variables based on a Financial Sector Deepening Trust report on Mozambique

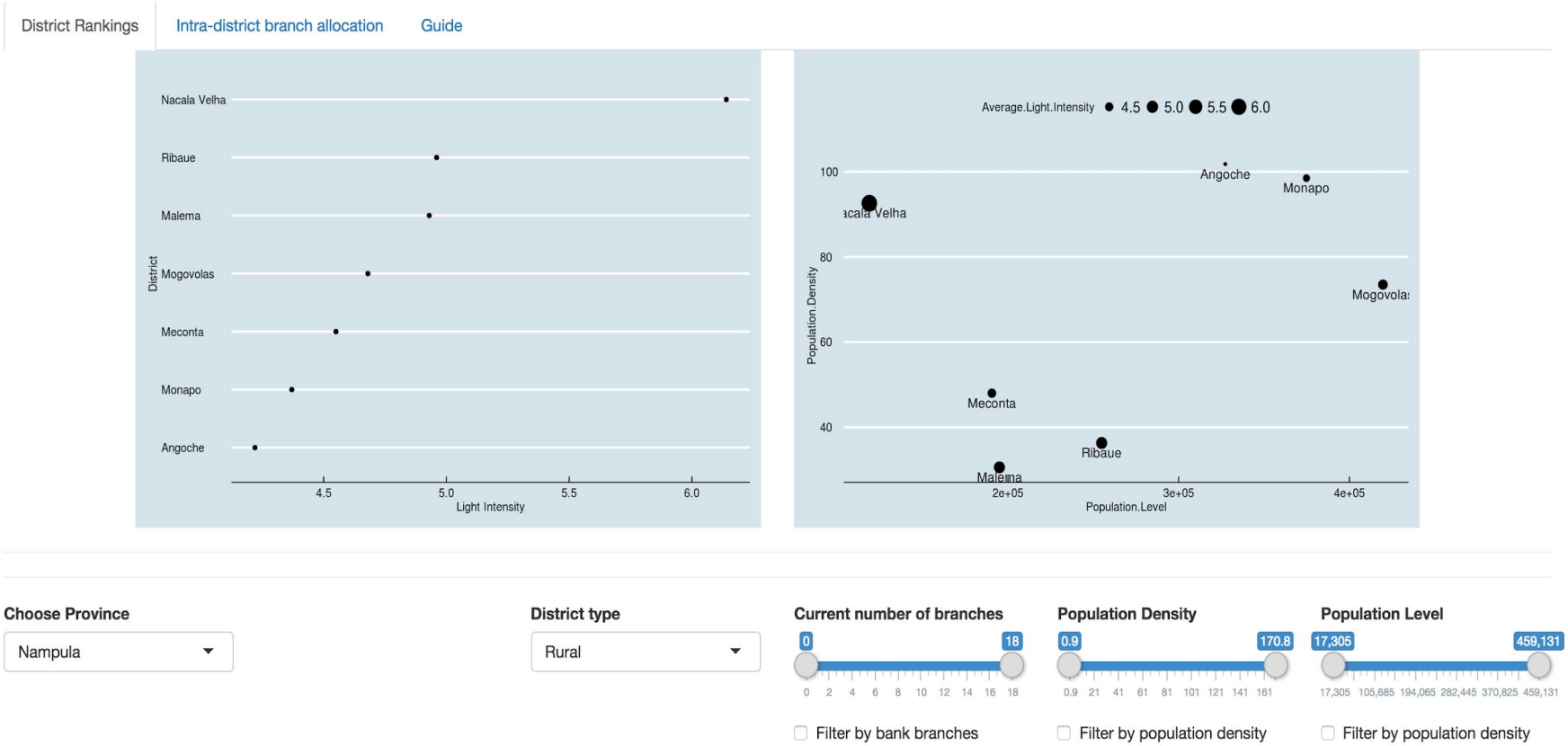
District identification

- Developed a filtering tool that allows users to filter districts based on district level data
- Provides simple ranking plots and scatterplots to compare districts
- Allows users to identify districts based on suitability metrics of their choice

Stage I: Identify districts

Select districts by financial access and population density

Rank selected districts by light intensity

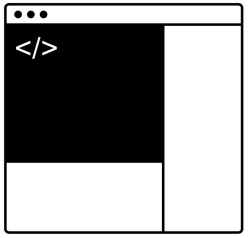


Stage II: Identify coordinates within districts

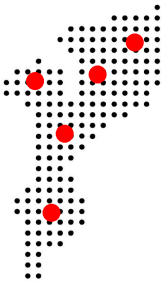
Once specific districts are selected in the second stage, we moved to Stage III to identify areas within districts by making use of the NL data.

Stage II includes a three step process...

District of interest is mapped using the NL data where the pixels are colored by the NL intensity



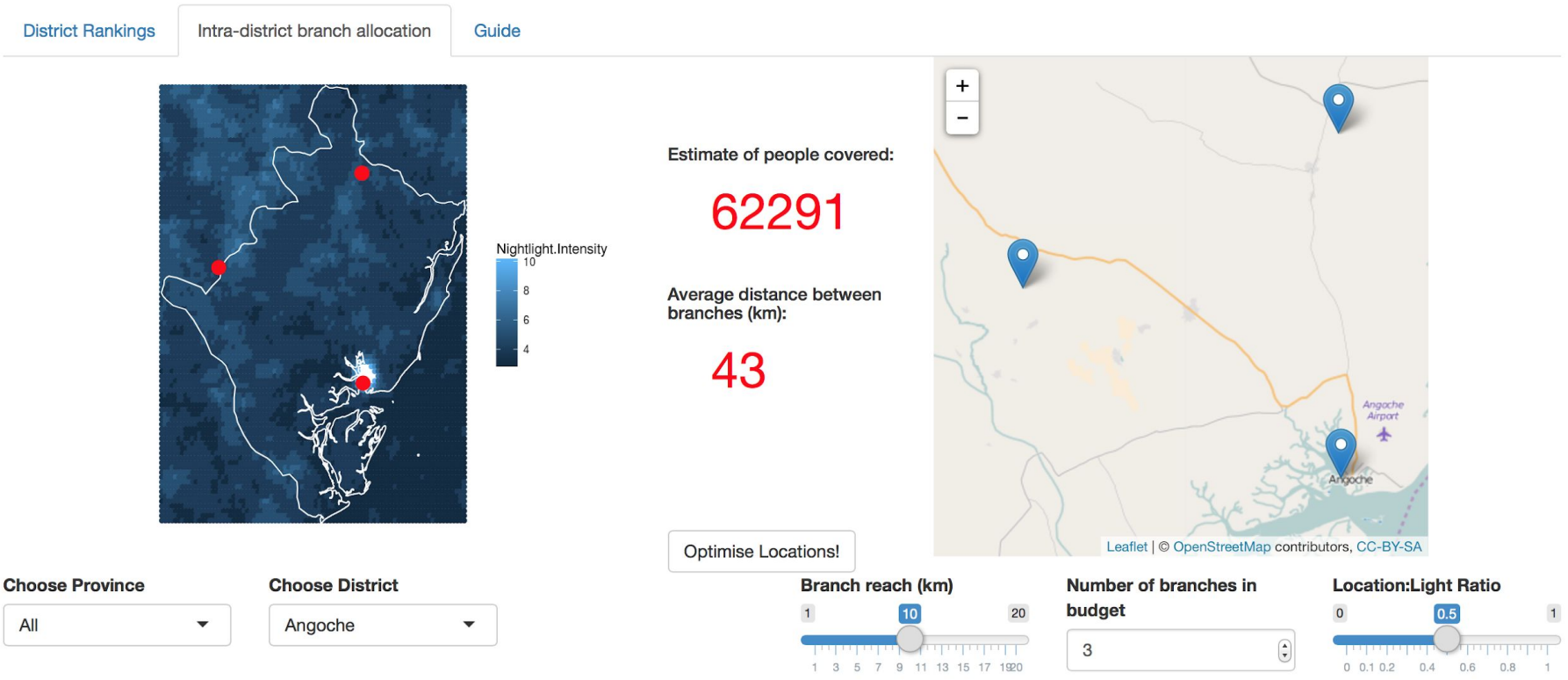
Create an algorithm to optimize the location of financial institutions within that district



Identify most optimal coordinates within a district to locate FS outlets

Stage II: Identify coordinates within districts

Based on criteria set, the algorithm picks geographic coordinates that optimizes light intensity and service area coverage

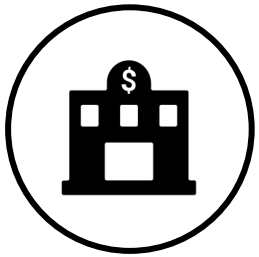


Stage II: Under the hood

Problem: How do we ensure access to institutions for all, while also targeting the dense / more active areas?

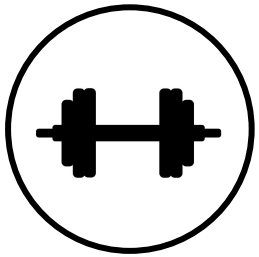
Optimisation: Minimise total distance to institution(s) subject to light intensity

1 Define no. of branches



Define the number of branches (K) that the client wants to deploy in the district

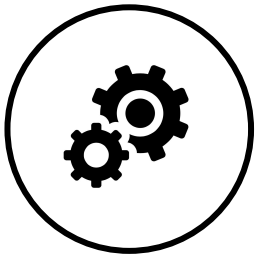
2 Weight coordinates



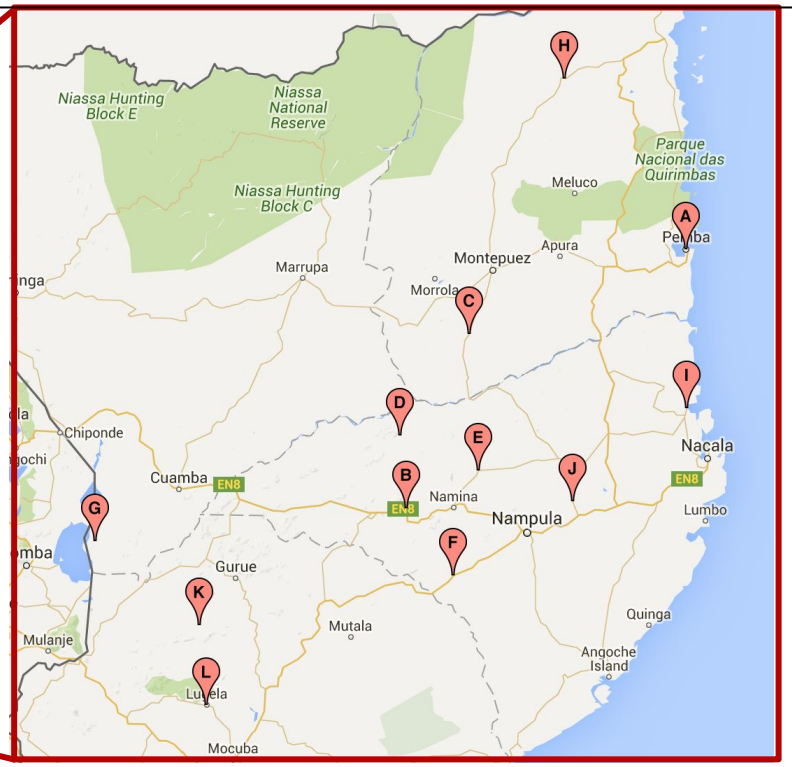
Weight each coordinate in the district by its light intensity and a tuning parameter

$$w_{ij} = e^{(\gamma L_{ij})}$$

3 Optimize locations

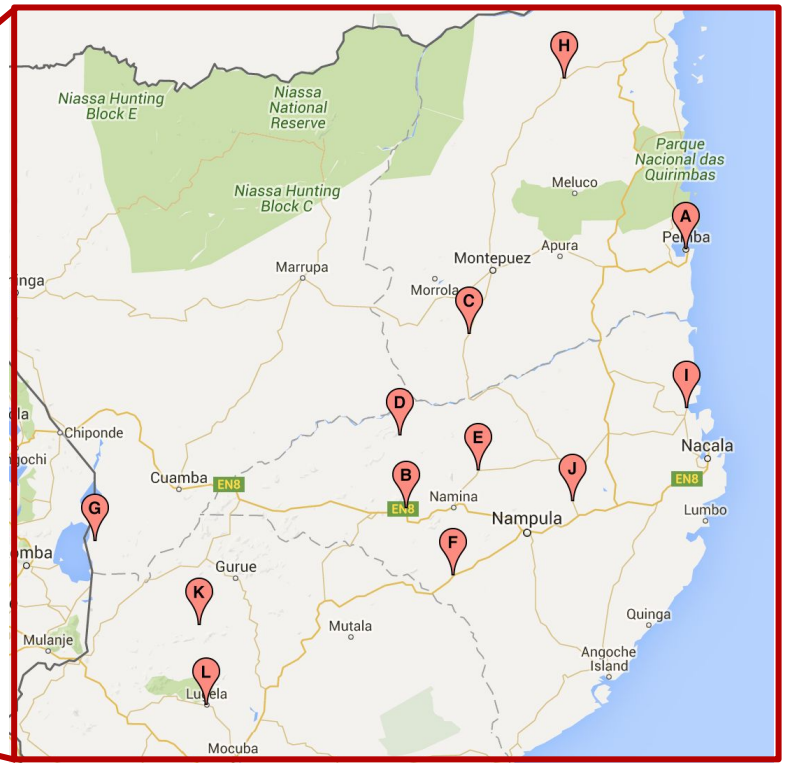


Return the centres of the K clusters which optimise the distance between branches and light intensity



A	Pemba	G	Mecanhelas
B	Ribaue	H	Mueda
C	Namuno	I	Memba
D	Lalaua	J	Muecate
E	Mecuburi	K	Namarroi
F	Murrupula	L	Lugela

Suggested districts for intervention



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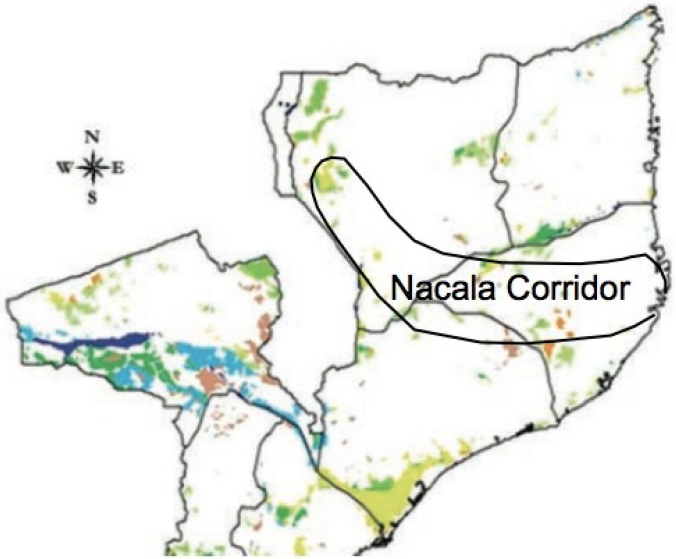
Click for demo

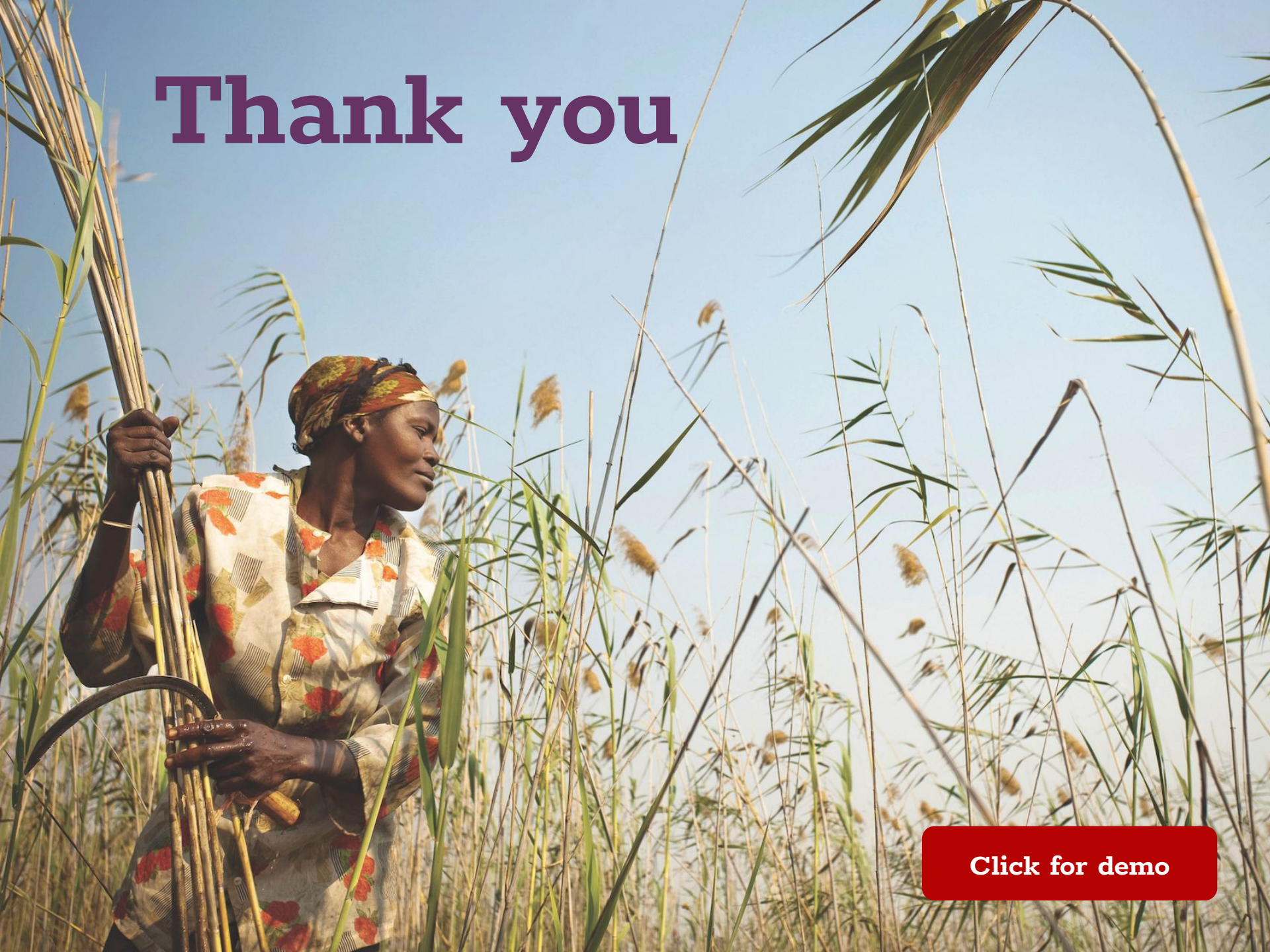
Policy recommendation

MAIN FINDING: All of the most attractive districts fall in the four northern provinces where the economy of this region is driven by extractive industries and transport of commodities along the (east-west) Nacala corridor.



1	2	3
Establish policy link	**Promote M/SME Development**	**Recognize banks for FI activities**
Establish policy link between resource-led growth and financial sector development. Financial sector could benefit from the growth of extractive industries.	**Develop policies and programs for M/SME development particularly in the northern regions that will garner the interest of financial institutions E.g. SME - bank linkage programs**	**Create incentive structures for banks and financial institutions to cater to the rural and poor population E.g. Rural-Urban branch ratio, Subsidized lending, Priority Sector Lending, etc.**

Thank you



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